Calleguas Creek Watershed Organochlorine Pesticides, Polychlorinated Biphenyls, and Siltation TMDL

Revised Staff Memorandum

Introduction

This Staff Memorandum presents the elements and implementation plan of the tentative Calleguas Creek Watershed Organochlorine (OC) Pesticides, Polychlorinated biphenyls (PCBs), and Siltation TMDL. The OC Pesticide, PCBs and Siltation TMDL was developed through a collaborative, stakeholder-led process, which was responsible for the technical analyses leading to the Regional Board staff's recommended TMDL. The development of the siltation portion of the TMDL was led by Regional Board staff. This memorandum provides a brief overview of the TMDL development, and responds to inquiries by Regional Board members at the Workshop on the Organochlorine Pesticides, Polychlorinated Biphenyls, and Siltation TMDL in Calleguas Creek, its Tributaries and Mugu Lagoon on May 5, 2005.

Specifically, this memorandum addresses the rationale for the TMDL Implementation Plan, the basis for the time to attain water quality standards, and an evaluation of costs and benefits of TMDL implementation. The discussion below provides the technical justification for the Implementation Plan elements, how those elements will be integrated, and an evaluation of the costs and benefits based on an external cost model. Finally, this memorandum reviews the stakeholder led process by which this TMDL was developed. It is organized according to the sections: I. Implementation Rationale; II. Siltation Analysis; III. Implementation Schedule; IV. Economic Issues; V. TMDL Development; VI. Key Documents; VII. References.

I. Implementation Rationale

Staff developed the proposed implementation plan based on the chemical, physical, and biological properties of the impairing constituents. Staff also considered the land uses and hydrologic characteristics of the Calleguas Creek Watershed, and integrated established practices for the restoration of waterbodies impaired by historic pesticides.

Organochlorine (OC) pesticides and PCBs are known as persistent organic pollutants (POPs), because they continue to magnify and accumulate and in the food chain 30 years after they were banned by most developed countries. OC pesticides were developed for agricultural use and contaminate the watershed through agricultural and storm runoff. PCBs were developed as electrical and heat insulating materials. Spillage and improper disposal are likely mechanisms for contamination of the watershed by PCBs. POPs are also semi-volatile, which allows them to vaporize and/or sorb onto atmospheric particles, making atmospheric deposition a source of POPs, especially in coastal areas. Monitoring

studies have not identified areas of high concentrations, i.e. hotspots, for OC pesticides or PCBs in the waterbodies, sediments or soils.

The Implementation Plan proposed by staff is comprised of the following elements:

- natural attenuation
- source control
- best management practices
- removal actions

1. Natural attenuation includes processes such as biological degradation, volatilization, dispersion, dilution, and sorption onto organic material (Mulligan and Yong 2004). The authors of the TMDL concluded "that natural attenuation of OCs is occurring already, due to degradation, burial, and flushing to the ocean" (pg 87). Attenuation may be occurring in the Calleguas watershed, but it is neither adequate nor reliable as the sole method for removal, due to the slow degradation rate. Also, flushing to the ocean does not represent attenuation; rather, it represents transfer of the problem to another site. This last point was noted by the peer reviewer and confirmed by the increasing trend in DDE in fish tissue measured by the Oxnard drain, north of Mugu Lagoon (see time plot for DDE). Therefore, staff finds additional methods are necessary to ensure that numeric targets are met within the prescribed timeframe.

2. Although the ban on most PCBs and OC pesticides serves as source control, there may be unused stores of these chemicals. Therefore, the implementation plan includes pesticide disposal events for both urban and agricultural stakeholders.

3. Best management practices (BMPs) are focused on reducing sediment loads to Calleguas Creek from both agricultural runoff and stormwater overland flow. Such practices include retention basins and filter strips, which reduce sediment transport from irrigated lands. Additional BMPs address stormwater management and include vegetating slopes of drainage channels and installation of energy dissipaters. BMPs will be implemented through the Ventura County MS4 permit and the forthcoming Conditional Waiver for Irrigated Lands.

Similar BMPs were employed successfully in the state of Washington, in the Lower Yakima River. Due to the high correlation between turbidity and total suspended solids (TSS), and between DDT (total) and TSS, the Washington State Department of Ecology (WSDE 1997) established a TMDL for pesticides in the Lower Yakima River using turbidity targets. Turbidity is controlled by reducing soil erosion and by increasing water conservation. The peer reviewer for this TMDL noted the linkage between historic pesticides and PCBs and sediment, and indicated that load reductions necessary to attain water quality objectives for historic pesticides and PCBs are unlikely to be attained without sediment load reductions.

4. Removal Actions are ideal for hot spots of contamination, but TMDL monitoring has not yet identified hot spots within the watershed. The monitoring plan, which focuses on

a subwatershed analysis, will facilitate identification of high concentration areas. When these areas are identified, removal and proper disposal will be implemented. Dischargers will submit a workplan to identify the appropriate levels for removal.

The following table includes several technologies available to augment natural attenuation and best management practices: treatment of sediments, soil and sediment removal, and sequestration. Selection of the appropriate technology rests on several factors, including the type of media impaired, the mass and volume of impacted media, and the biological processes affecting both the magnification and attenuation of the contaminants. In general, treatment costs normalized to a contaminant mass basis increase as the concentration in soil or sediment decreases.

Summary of Technologies for Addressing Historic Pesticide and PCB Impairments

Technology	Examples	Remarks for Calleguas Creek
Treatment	Incineration, chemical oxidation, filtration	Not cost effective for Calleguas Creek Watershed due to diffuse concentrations of historic pesticides and PCBs
Source Control	Proper disposal of unused pesticides	Effectiveness dependent on the amount of unused pesticides; can be integrated into other TMDL Implementation Plans
Capping	Cover with clean sediment	Effectiveness dependent on identification high concentration sediment areas.
Removal Actions	Dredging, excavation	Effectiveness dependent on identification of hot spots
Natural Attenuation	Degradation	Effectiveness limited in many applications and dependent on site specific conditions.
Best Management Practices	Sediment control; debris basins, filter strips	Effectiveness dependent on design and maintenance

II. Siltation Analysis

The Siltation Technical Memo included in the Board Package contains sediment allocations to reduce sedimentation mass loads in Mugu Lagoon, where conversion from wetland habitat to upland habitat has been documented (pg 2, Siltation Memo). This portion of the TMDL is necessary to protect the beneficial uses of Mugu Lagoon, because the threat of siltation was not addressed by the OC Pesticide and PCBs portions of the TMDL.

The Siltation portion of the TMDL is also an effective means to control pesticide loading into Mugu Lagoon. Dr. Neal Armstrong, the peer reviewer, confirmed the most

effective way to meet target concentrations of OC pesticides in sediments is through BMPs to "control soil erosion and siltation from areas with the highest OC sediment concentrations" (pg 5, Peer Review). Similar measures were employed successfully in the state of Washington, in the Lower Yakima River, in the Suspended Sediment and DDT TMDL (WSDE 1997). Due to the high correlation between turbidity and total suspended solids (TSS), and between DDT (total) and TSS, the Washington State Department of Ecology established a TMDL for pesticides in the Lower Yakima River using turbidity targets. Turbidity is controlled by reducing soil erosion and increasing water conservation. A positive correlation was also found between DDE and TSS in the Calleguas Watershed (pg. 92, OC Pesticide and PCBs TMDL).

The wasteload and load allocations is an annual average sediment mass reduction of siltation allocation is 2496 tons/year for MS4 permittees and 2704 tons/year for agricultural sources based on Staff's assessment of the 1995 US Department of Agriculture and National Resource Conservation Service Study on Calleguas Creek Sedimentation and Mugu Lagoon. The study estimated sediment loss by land use type with the Universal Soil Loss Equation and NRCS soil information.5,200 tons/year to prevent habitat reduction in Mugu Lagoon. The Implementation Plan for the Siltation portion of the TMDL includes a special study overseen by a Science Advisory Panel, to characterize sedimentation and changes in habitat in Mugu Lagoon. This study is necessary due to the variable sedimentation rates estimated for Mugu Lagoon (85,600 – 849,000 tons/year, pg. 3 Siltation TMDL). The Regional Board will re-consider sediment load and wasteload allocations based on the results of the Special Study.

III. Implementation Schedule

The proposed implementation schedule considers many of the uncertainties identified in the TMDL analysis. The key uncertainties pertain to the effectiveness of the source control and high-concentration area removal actions, best management practices for reducing sediment and pollutant loads from both agricultural and flood control activities, and the natural attenuation rate in various parts of the watershed. One of the greatest areas of uncertainty for this TMDL is the effectiveness of natural attenuation. A wide range of reported attenuation rates from laboratory to field studies over several orders of magnitude are reported in the technical literature. Further, there have been very few successful field scale restorations of POPs.

Given these uncertainties and the costs associated with removal actions and BMPs, the TMDL sets forth several special studies to ensure such actions will result in cost effective reduction of contaminant loading. Staff finds the implementation and assessment of BMPs for agriculture to be on the order of 5-10 years. Then, after implementation of the BMPs, contaminant-laden soils and sediment will require additional time to stabilize under wet weather events.

Because the load reduction for many of the constituents is fairly substantial, staff assesses that an iterative approach to effective load reductions will be required. The

TMDL reductions will require monitoring the effectiveness of BMPs after they are implemented and adjusting or revising such practices as necessary. Again, this approach accounts for the above uncertainties and will require time to attain water quality objectives.

Given the need to conduct special studies, implement and evaluate best management practices, and modify and refine the best management practices to achieve effective load reductions, staff has proposed a 20-year implementation schedule.

IV. Economic Issues

The estimated costs of removing historic pesticides and PCBs from the Calleguas Creek watershed are comprised of monitoring and reporting costs and the costs of implementing Best Management Practices. The costs of mitigation cover a wide range, from no cost for changes in irrigation practice to $38 million for the construction of a large sediment basin in the lower Callegaus Creek watershed. Since historic pesticides and PCBs are transported via sediment, BMPs should be aimed at sediment control and/or removal. Other BMPs that may be effective, such as filter strips and cover cropping can also reduce the loads of historic pesticides and PCBs transported through the watershed.

The cost estimate is based on the costs for a sediment retention basin, which could prevent most of the sediment from entering Mugu Lagoon. This project is under planning and evaluation by the Ventura County Watershed Protection District. The basin would then be monitored and dredged to remove and dispose of the historic pesticides and PCB laden sediment. The installation of the sediment basin would cost approximately $38 million. Federal and state grants could significantly reduce the costs to local industry and flood control districts. Dredging and disposal costs for removing the sediment-bound historic pesticides and PCBs are estimated at approximately $1 million annually.

Initial Estimate of Benefits

Estimates of costs of leaving historic pesticides and PCBs in place in the Calleguas Creek watershed are based on a study titled “External Costs of Agricultural Production in the United States” published in the International Journal of Agricultural Sustainability in 2004. The authors divided external costs into several “Damage Categories” associated with agricultural production, such as bird kills due to pesticides and negative impacts to the fishing industry. Therefore, if historic pesticides and PCBs were removed from the watershed, the benefits associated with that removal could be estimated using the agricultural externalities as a baseline. The national cost estimate for damage due to agricultural practices (excluding damages not related to the presence of historic pesticides) ranges from $5.9 billion to $10.7 billion annually. The per-acre cost estimate ranges from $14.10 to $25.60. These figures are multiplied by the total

agricultural acres in Calleguas Creek to obtain a total annual watershed cost range of $1.08 million to $1.97 million.

Recreational Value

Staff also evaluated cost externalities based on recreational value. Staff obtained an estimate of annual visitors to the Conejo Recreation and Park District. The total number of annual users, including repeat visits, is estimated at 1,393,947 person/days. Since visitation estimates were only available for Conejo RPD (which represents a portion of the recreational facilities in the Calleguas Creek watershed), the estimate was used as an average and was extrapolated to the entire Calleguas Creek watershed. The resulting estimate of annual visitation in person/days is 7,708,527. Using a study published by the NRCS titled "Comparison Study of 700 Recreational Studies by the Forest Service that has US and Regional Average User Day Values by type of activity", a General Recreation value of $22.27 was multiplied by the number of person/days to obtain an annual recreation value for Calleguas Creek of $171,668,894. According to the NRCS site, the recreation values listed are very conservative and may represent as little as 20% of the true value. Therefore, the recreation value for Calleguas Creek could rise even further. The difficulty in using this recreation value is that there are no good methods for determining the forgone benefits due to historic pesticides and PCBs. A contingent valuation study is needed to estimate the Willingness to Pay for historic pesticide and PCB removal. Consequently, the recreational benefit of leaving historic pesticides and PCBs was not considered in this cost estimate.

Interim Lost Use Value

Interim Lost Use Value (ILUV) provides a monetary measure of the compensation due the public as a result of injuries to public property, including natural habitat and threatened or endangered species. Since no ILUV study has been conducted on Calleguas Creek, for the purpose of comparison staff investigated the interim lost use value based on the work associated with DDT release to the Palos Verdes shelf. DDT was released from the Montrose site in Torrance into the storm and sewer systems during the 1940s through the 1960s. This DDT ended up in the Southern California Bight off the coast of Los Angeles, where it settled into the sediment and entered the food chain. The pesticide continues to affect several species, including bald eagles, peregrine falcons, kelp bass, and white croaker. The National Oceanic and Atmospheric Administration commissioned a study by Natural Resource Damage Assessment, Inc. to estimate the prospective interim lost use value. A contingent valuation survey was administered in which the public was asked to vote for or against a government clean-up program financed by a one-time income tax surcharge on California households. The interim lost use value was estimated at $575 million. Because no such study has been conducted in the Calleguas Creek watershed, staff is unable to report a direct interim lost use value for damage to Mugu Lagoon due to DDT. However, through the use of the benefit transfer method, it is likely that much of Lost Use Value obtained for the Southern California Bight would apply to the Calleguas Creek Watershed due to the biological significance of Mugu Lagoon.

Until a benefit transfer calculation is completed for Calleguas Creek, staff will estimate the benefits associated with the removal of historic pesticides and PCBs from the watershed at $2 million annually.

Present Value Comparison

Present values of the costs for actively removing historic pesticides and PCBs and leaving these materials in place were compared. The assumptions for the present value analysis are based on the costs for removal at $38 M to be incurred in 10 years for construction of the remedy described above, the external costs of $2 million per year from the present time to 10 years, and $1 million per year for 10 additional years after the construction of the sediment basin in year 10. The costs of leaving the historic pesticides and PCBs in place are estimated at $2 million for 100 years. An annual discount rate of 5% was assumed for the present value calculations.

These cost scenarios yield essentially equivalent present values of approximately $40 million. Staff opine that the sensitivity analysis would yield a higher present value cost for leaving the constituents in place because recreational and lost use value costs were not included in the analysis.

Conclusion

Further study is needed to determine the true benefit of DDT mitigation in Calleguas Creek. A contingent valuation study would provide the most accurate estimate, but requires a lot of time and money to administer. The benefit transfer method may provide a good benefit estimate without requiring much extra effort. The interim lost use value estimated for the Southern California Bight could be transferred to Calleguas Creek to obtain a benefit estimate for DDT mitigation. Because of the unique biological significance of Mugu Lagoon, it is likely that the Interim Lost Use Value for damage to the lagoon from DDT could equal the ILUV for the Southern California Bight. Therefore, the $40 million estimate for present value of benefits for DDT mitigation is a lower bound estimate. Actual present value of benefits could rise as high as $600 million.

V. TMDL Development

Calleguas Creek stakeholders have been actively engaged with US EPA and the Regional Board on a variety of watershed planning initiatives through the Calleguas Creek Watershed Management Plan (CCWMP), an established, stakeholder-lead watershed management group, operating since 1996. The CCWMP includes broad participation from Federal, State and County agencies, municipalities, POTWs, water purveyors, groundwater management agencies, and agricultural and environmental groups. As part of its mission to address issues of long-range comprehensive water

resources, including land use, economic development, and open space preservation, the CCWMP proposed to the US EPA and Regional Board to take the lead on development of the TMDLs for the Calleguas Creek Watershed.

The CCWMP worked with US EPA and Regional Board staff to define their respective scope of activities for the OC Pesticides, PCBs, and Siltation TMDL. The CCWMP, with partial funding from US EPA, engaged a contractor, Larry Walker Associates, to develop a workplan under which this TMDL was developed. The workplan was first submitted to the Regional Board in January, 2003. Based on Regional Board staff review and comments, the workplan was revised in June, 2003 and approved in July, 2003. The workplan addressed the methods and schedule for watershed monitoring, source and linkage analysis, development of wasteload and load allocations, and the administrative structure through which stakeholders and the public were informed on TMDL development. Work commenced in October, 2003 with the submittal of the final TMDL report by Larry Walker Associates in January, 2005.

During the development of the TMDL reports, Regional Board staff worked with US EPA, the CCWMP and staff from Larry Walker Associates on a frequent and regular basis. Outreach and stakeholder comments were solicited through the CCWMP structure, which included monthly steering committee meetings and several subcommittee meetings responsible for various aspects of watershed management. These meetings were open to the public; agendas and meeting minutes were also published on the CCWMP website: www.calleguascreek.org. In addition to the monthly meetings, the CCWMP, Regional Board and US EPA staff, and a representative from the City of Camarillo, Sanitation Department, met on a monthly basis to discuss TMDL issues. These meetings were facilitated and noted by staff of the CCWMP, and several of these meetings were attended by representatives of the Calleguas Creek Watershed POTWs, Heal the Bay, and the Ventura County Coastkeeper. Finally, the CCWMP arranged and hosted a public meeting with invitations mailed to 3,000 persons in the watershed in January, 2005.

In addition to stakeholder and public involvement, the workplan also set forth a Technical Advisory Committee composed of independent reviewers from Universities and National Laboratories for technical review. The Technical Advisory Committee considered issues such as numeric targets, margin of safety, and load allocations. Comments from the Committee were addressed by Larry Walker Associates, and the record of communications, comments and responses were included as an appendix to the TMDL Report.

The development of the TMDL reports followed a process in which the CCWMP and LWA prepared draft documents for discussion. Regional Board and US EPA staff considered these approaches and in some instances provided alternative proposals. These alternative proposals were brought back to the CCWMP for consideration and the CCWMP provided direction to LWA staff on how to address the modifications. During development of the TMDL reports, differences between the US EPA, CCWMP, LWA and the Regional Board staff on technical and policy issues were carefully considered and the TMDL Technical reports include the compilation of input from all of these sources

and represent the discussions and compromises of the stakeholder process. The language of the technical report attempts to capture some of the resolutions to the differences and reflects the unique nature of this process.

VI. Key Documents

Regional Board staff's tentative TMDL for OC Pesticides, PCBs, and Siltation, including numeric targets, allocations, and implementation plan, was based on the work by the CCWMP, its contractor, Larry Walker Associates, and Regional Board Staff. The TMDL technical analyses are contained in two reports: 1. "Calleguas Creek Watershed OC Pesticides and PCBs TMDL Technical Report, June 20, 2005" and "Technical Components of the Magu Lagoon Siltation TMDL for Calleguas Creek, June 16, 2005" (items 19-4 and 19-5, respectively). Records of meetings and communications will be available in the Administrative Record for this TMDL.

VII. References

Comparison Study of 700 Recreational Studies by the Forest Service that has US and Regional Average User Day Values by type of activity, USDA, NRCS, 2001. http://www.economics.nrcs.usda.gov/technical/recreate/

External Costs of Agricultural Production in the United States, Erin M. Tegtmeier and Michael D. Duffy, International Journal of Agricultural Sustainability, Vol. 2, No. 1, 2004.

Mulligan, C.N. and R.N. Yong. 2004. Natural Attenuation of Contaminated Soils. Environment International, **30**: 587-601.

Prospective Interim Lost Use Value Due to DDT and PCB Contamination in the Southern California Bight, Natural Resource Damage Assessment, Inc., La Jolla, Calif., September, 1994.

Recreation person/day estimate for Conejo Recreation and Park District obtained from Bill Palermo, Park Operations Analyst.

Washington State Department of Ecology (WSDE). 1997. A Suspended Sediment and DDT Total Maximum Daily Load Evaluation Report for the Yakima River. Publication No. 97-321. See: www.ecy.wa.gov/biblio/97321.html.